NEW ROTIFERA (ASCHELMINTHES) FROM TASMANIA

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Summary

KOSTE, W. & SHIEL, R. J. (1986) New Rotifera (Aschelminthes) from Tasmania. *Trans. R. Soc. S. Aust.* **110**(3), 93-109, 28 November, 1986.

One hundred Tasmanian aquatic habitats were surveyed for Rotifera in Spring 1985. Of 130 species identified, 63 were first records for Tasmania, 17 new to Australia and four (*Brachionus lyratus tasmaniensis* ssp. nov., *Lepadella tana* sp. nov., *Cephalodella lindamaya* sp. nov., and *Testudinella mucronata tasmaniensis* ssp. nov.) new to science, bringing to approximately 200 the rotifers known from the island. New taxa are described and figured; several of the first records for Australia also are figured, and ecological and zoogeographical peculiarities of the Tasmanian Rotifera are discussed.

KEY WORDS: Rotifera, new species, new records, Tasmania, zoogeography.

Introduction

Until recently rotifers were considered cosmopolitan, but it is becoming increasingly evident that there are distinct zoogeographic associations (Dumont 1983). Some 600 species of more than 2000 rotifer taxa known worldwide are recorded from Australian inland waters, and there is increasing evidence for the radiation of some groups in southern Australia [e.g. >30% endemicity in the brachionids (Shiel 1983)]. Tasmanian records were necessary to define the zoogeographical trends apparent across the south-east and south-west of the continent; however, the literature on the Tasmanian rotifer fauna is notably sparse (Sudzuki 1967, 1985; De Deckker & Williams 1982). The abundance of permanent standing waters on the island and high rainfalls relative to the mainland suggested a rich fauna should occur.

The first surveys of Tasmanian waters specifically for rotifers established that a diverse planktonic and littoral rotifer association was present: 131 taxa in 34 genera were identified by Koste & Shiel (1986a). Only 3% of these appeared to be restricted to Tasmania, and a radiation of brachionids comparable to that of the mainland was not evident. Notable, however, were the "tropical" affinities; in sample series from April 1980 and May 1984, rotifers previously considered pantropical in distribution were widely distributed, possibly reflecting Tasmania's moderate maritime climate.

To investigate further these unexpected rotifer associations, and to add information on seasonal variations in species composition and diversity, a further survey of >100 fresh-saline habitats was made in Nov.-Dec. 1985. This paper reports on the results, and in particular the Rotifera new to Tasmania and Australia. We summarise ecological observations in the context of this survey; full details of ranges of water quality for each species are included in a continuing revision of the Australian Rotifera (Koste & Shiel 1986b, 1987). Other components of the survey, particularly Protozoa and microcrustacea, will be treated later (Shiel & Tan in prep.).

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Materials and Methods

Sites sampled are shown in Fig. 1. Most sites sampled in the two earlier autumn surveys were visited again. However, unusually high rainfall and flooding in early December prevented collections in some of the midland localities. Habitats sampled in 1985 ranged from ephemeral flooded roadside ditches (15), permanent marshes (5), stock dams (46), streams (4), rivers (5) and their impoundments (18), large natural lakes (10), a marine-associated basin (1) and the Hobart Botanical Gardens duck pond.

All sampling was from margins in small habitats, from wader-depth in larger habitats, and where possible from the retaining wall over deep water in impoundments. More stock dams were accessible by road than other habitats, hence the greater sampling frequency.

Physical parameters measured in the field were: temperature (hand held 50°C alcohol thermometer), conductivity (TPS LC81 Conductivity meter) and pH (Radiometer 29 portable pH meter). Plankton samples were collected using a 37 μm-mesh cone net (3 × 6 m tows), littoral taxa by a 50 μm-mesh cone net fitted with a 30 cm-aperture stainless steel Birge cone, and small lentic habitats were sampled using a 10 *l* bucket and pouring 2–3 volumes through a 37 μm stainless steel mesh fitted to a specimen vial. All samples were concentrated to 100–120 ml and preserved with 4% formalin in "Whirl-Pak" plastic bags for transport.

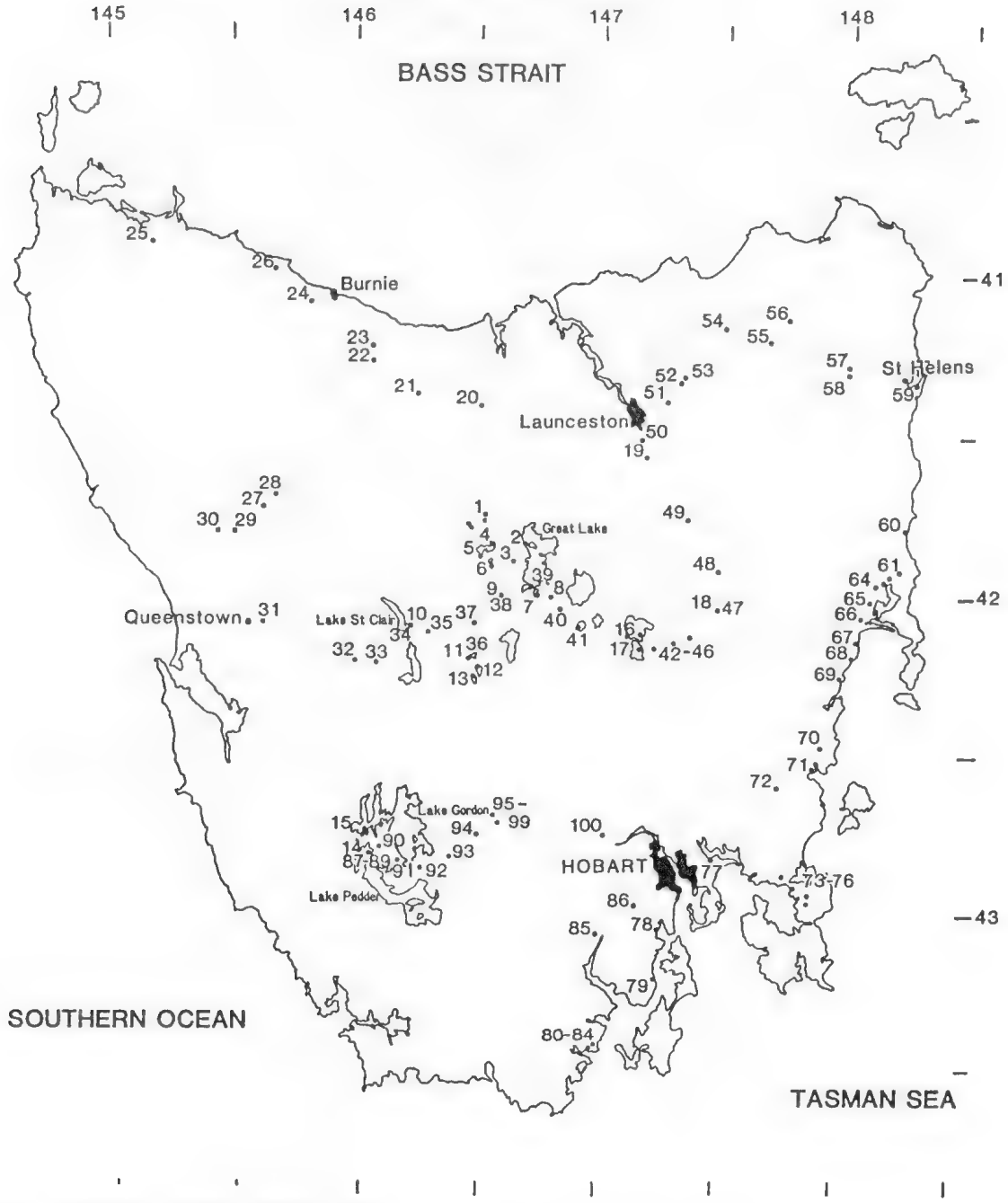


Fig. 1. Sampling sites from 1984–85 surveys.

Results

Ranges of water quality recorded were as follows: Water temperature 12.0–29.0°C; conductivity (K_{18}) 14.6–34 800 μS cm^{-1}; pH 3.1–8.9. Most localities sampled had dark, tea-coloured humic waters, 81% below pH 7.0, and were low in electrolytes (52% <100, 40% 100–1000, 8% >1000 μS cm^{1}). The few higher salinity localities either were influenced by proximity to the sea (e.g. Diana's Basin and stock dams near St Helens) or were subject to increasing salinization from human activities (e.g. Lake Dulverton, Oatlands).

Predictably, rotifer communities of most Tasmanian waters were dominated by acidophils.

One hundred and thirty rotifer species were identified from the 1985 sample series; 63 of these are first records (Table 1), bringing to approximately 200 the known Tasmanian taxa, and 17 are new to Australia (total now 620), including four new taxa described here.

Systematics

Brachionus lyratus tasmaniensis ssp. nov.
FIG. 2a–e

Material: 244 females in formalin, sample No. 1477, 36 ♀ ♀ sample 1478.

Holotype: Female lorica on microslide, sample 1477, Coll. 7.xii.1985, R. J. Shiel. South Australian Museum, SAM V4018.

Paratypes: Dates and place of collection as for holotype; two slides in the South Australian Museum, SAM V4026, SAM V4027.

Type locality: Turbid stock dam 200 m east of Karanja [Fig. 1:94, 42°45'S, 146°31'E], east side of Strathgordon road. Also present in a second dam about 45 m west. Neither dam had emergent vegetation. 19.5–22.0°C, pH 4.0–6.2, 228–242 μS cm^{-1}.

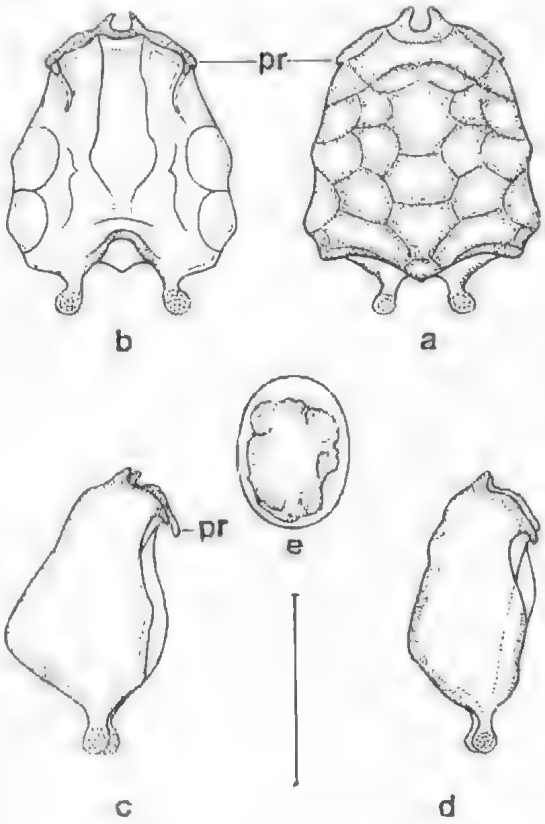


Fig. 2. *Brachionus lyratus tasmaniensis* ssp. nov. a. lorica, dorsal, b. lorica ventral, c–d. lorica, lateral, e. subitaneous egg. Scale bar 100 μm.

Description: Lorica shape resembles *B. lyratus* Shephard, 1911, but at anterior dorsal margin of head opening only short inwardly curving median spines present; intermediate spines absent. Lateral spines relatively long, blunt, curved towards ventral plate (Figs 2a–c *pr*). Dorsal surface facetted, with caudal median projection overlapping foot-opening. Club-shaped posterior projections curve outwards as in type, but covered with minute papillae. Ventral plate ornamentation resembles *B. pinneenaus* Koste & Shiel, 1983, but caudally a long ventral facet is lacking. Lorica granulated, more strongly on the dorsal plate.

Measurements: Lorica length 100–152 μm; width 75–120 μm; foot-opening dorsal 27 × 36 μm; subitaneous egg (Fig. 2e) 50 × 75 μm.

Discussion: The new taxon belongs to the endemic and morphologically distinct *Brachionus* group comprising *B. lyratus* Shephard, 1911, *B. keikoa* Koste, 1979 and *B. pinneenaus* Koste & Shiel, 1983. These taxa can readily be separated from the *Brachionus angularis* group after Ahlstrom (1940). Another distinct morph has been found recently in material from N.S.W. (T. J. Hillman, pers. comm.). Until this population is described (Koste & Shiel in prep.), and the extent of variation in the above Australian endemics is fully detailed, the Tasmanian material is regarded as a subspecies. The need for continued use of trinomials in rotifer systematics, which still is founded mostly on morphological and anatomical characteristics, is discussed by Koste & Shiel 1987.

Literature: Shephard (1911), Koste (1979), Koste *et al.* (1983).

Cephalodella lindamaya sp. nov.
FIGS 3a–f, 4

Material: Four more or less contracted females in formalin, sample No. 1432.

Holotype: Female with contracted head in lateral position on slide, sample No. 1432. Coll. 1.xii.1985 R. J. Shiel. SAM V4019. Iconotype microphotograph Fig.4.

Paratype: Date and place of collection as for holotype. SAM V4028.

Type locality: Stock dam 1 km south of Copping (Fig. 1:73, 42°49'S, 47°48'E), west side Hwy 7; black, humic water, peripheral reeds; 21.7°C, pH <4, 80 μS cm^{-1}.

Description: Body short, stout; head short, very broad, slightly deflexed, oblique anteriorly; neck well-marked. Lorica weak, plates not readily visible. Foot normal, toes relatively long, somewhat swollen basally (Fig. 3c), medially slender, terminating in slightly curved claws with acute points. Four small, acute spinules inside this well-marked terminal part.

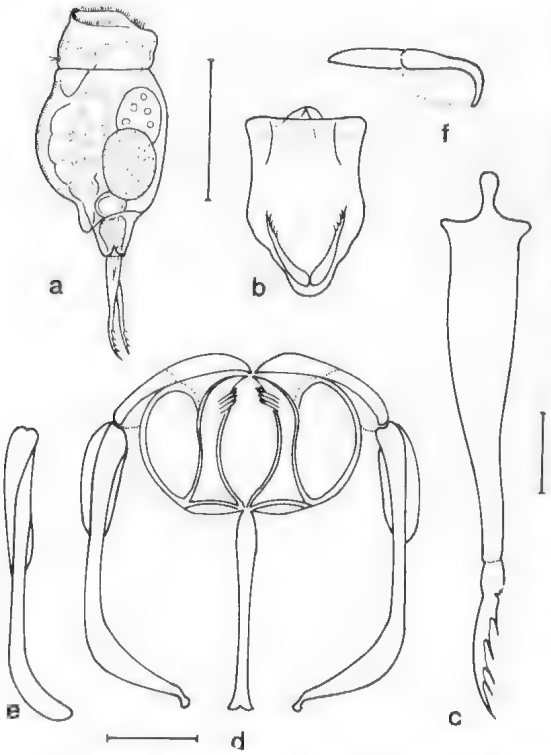


Fig. 3. *Cephalodella lindamaya* sp. nov. a. female, lateral (slightly contracted), b. completely contracted, ventral, c. toe enlarged with claw and spinules, d. trophi, e. manubrium, apical, f. uncus, Scale bars a, b 100 μm, c 10 μm, d–f 10 μm.

Mastax large (Fig. 3d); rami spherical, with denticulate inner margin behind points; fulcrum long, slender; uncus with one tooth, lamellar projection attached at its base; manubria unusual, terminally crutched and leaf-shaped, enlarged and distorted (Fig. 3d). This can be observed only in lateral view, cf. apical view (Fig. 3e). Foot-glands large and club-shaped (Fig. 3a).

Measurements: Total length of slightly contracted individual 245 μm (Fig. 3a); toes 68 μm (spinules 4–6 μm); trophi 43 μm (manubrium 38 μm, fulcrum 24 μm, unci 17 μm, rami 14μm).

Discussion: Only one individual was slightly extended; the others were contracted, however a valid species can be defined on the basis of hitherto unknown characteristics of trophi structure and toes with claws. Only *Cephalodella panarista* and *C. forficula s.l.* have spines or spinules at the edge of their toes (cf. Koste 1978 Pl 129:2d, 6b, e), but these are inserted dorsally. The construction and dimensions of the trophi, with distinctive manubria, differ from other taxa in the genus.

Etymology: named after Dr Linda May, Institute of Terrestrial Ecology, Edinburgh, in recognition of her work on Rotifera.

Fig. 4. *C. lindamaya*, iconotype micrograph of contracted animal.

Cephalodella mucronata Myers, 1924
FIG. 5h

This pantropical and subtropical species is known from isolated occurrences on the mainland (Mungindi R., northern N.S.W., Magela Ck, N.T. and ephemeral water of south-west W.A.). Three contracted individuals were recorded from separate localities in Tasmania: No's 1456 (Lake Pedder, 4.xii.1985), 1460 (roadside pool 4.xii.1985), 1506 (pool, buttongrass plain near Tullah, 11.xii.1985). All were contracted, with diatoms in the digestive tracts.

Measurements: Body to 173μm, toes to 137 μm.

Ecology: 17.5–29.0°C, pH 3.4–5.5, 34.1–59.3 μS cm^{-1}.

Lit: Koste (1978), Koste & Shiel (1980).

Proales cf. *fallaciosa* Wulfert, 1937
FIGS 5a–e

In samples 1458 and 1460, both roadside pools near the Strathgordon road (4.xii.1985), and 1475, Lake Fenton, Mt Field National Park (7.xii.1985), were more or less contracted illoricate vermiform rotifers (n=6, 4 and 2 respectively) which had a short papilla between the bases of the toes, as in *Proales fallaciosa* (cf. Koste 1978 Pl. 92:5a). Trophi analysis revealed a relatively long fulcrum and unci with only four teeth, in contrast to the asymmetrical trophi with 5–6/7 teeth of *P. fallaciosa.* See also the extraordinary toes with well-marked claws

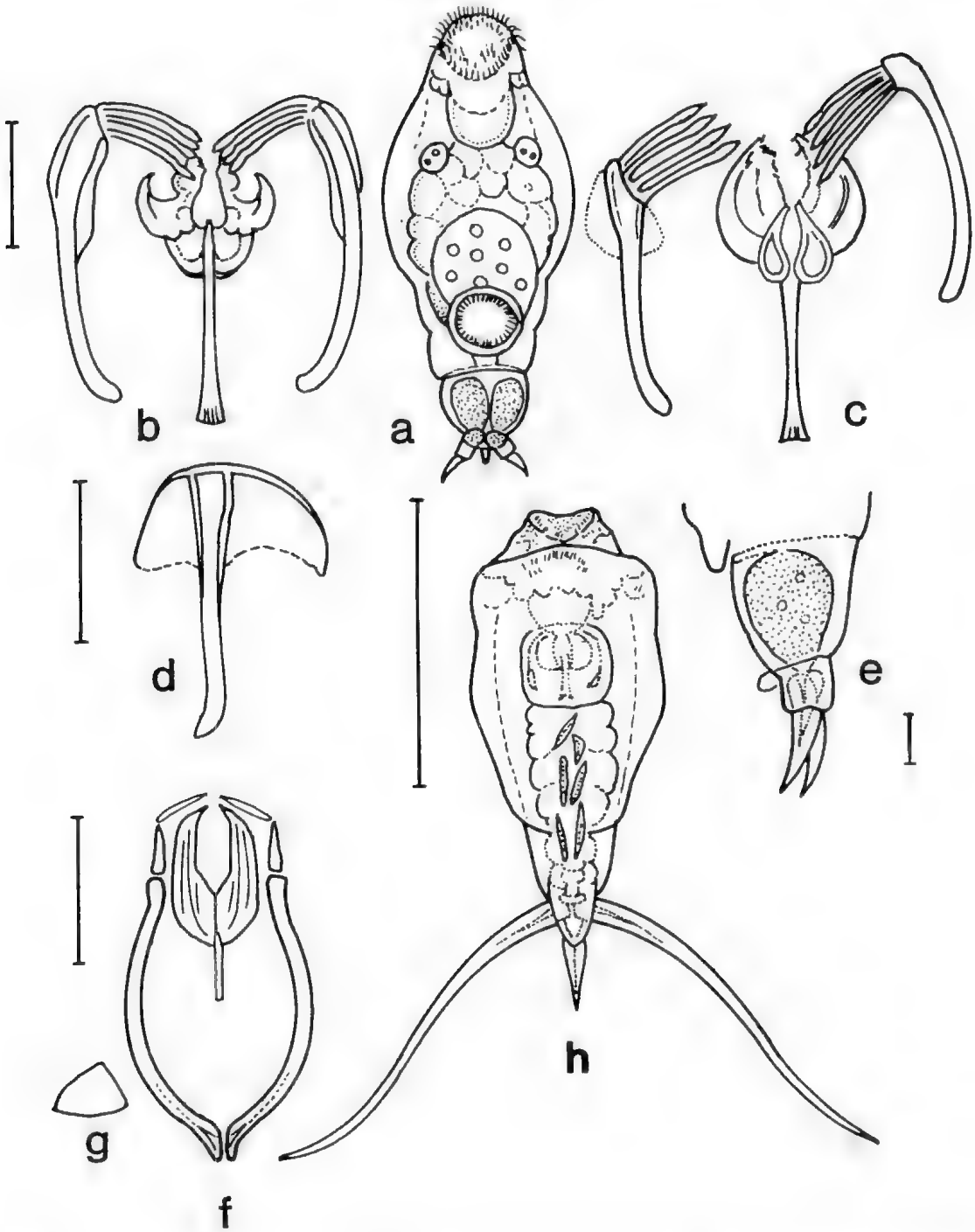


Fig. 5. a. *Proales* cf. *fallaciosa* Wulfert, 1937, contracted female, ventral, b. trophi, c. trophi compressed, d. manubrium, lateral, e. foot and toes, lateral, f. *Encentrum* cf. *diglandula* (Zawandowski, 1926), trophi, g. fulcrum. h. *Cephalodella mucronata* Myers, 1924. Female with contracted head. Scale bars a, h 100 μm, others 10 μm.

(Fig. 5e). This probably is a distant species, however an exact identification was not possible from the material. *P. fallaciosa* is known from the Magela Creek, N.T. (Koste 1981).
Measurements: Total length (Fig. 4:1a) 160 μm, toes 18 μm, trophi 21 μm, manubria 17 μm, fulcrum 12 μm, longest tooth of uncus 8.5 μm.

Encentrum cf. *diglandula* (Zawadowski), 1926
FIGS 5f, g

In sample 1460 (roadside pool, Strathgordon road, 4.xii.1985) were two contracted illoricate rotifers which (on digestion in hypochlorite) had trophi almost identical to those of *E. diglandula*, known till now only from Europe.
Measurements: Trophi length 25 μm (unci 5μm, intramallei 3 μm, fulcrum 5μm, manubria 18.5 μm). cf. Koste 1978:497.

Collotheca campanulata longicaudata (Hudson), 1883
FIGS 6a–d

In samples 1381 (stock dam, St Mary's road, 29.xi.1985), 1457, 1459, 1462 (Lake Pedder, 4.xii.1985) were populations of individuals attached to filamentous algae. Sudzuki (1985) recorded *C. campanulata campanulata* from Tasmania; it appears to be widely distributed in Australia. Fig. 6 shows individuals from sample 1462 (Scott's Peak Dam arm, Lake Pedder) in which we found 82 specimens of the ssp. *C. c. longicaudata*, mostly with contracted coronae and feet (Fig. 6d), but a few were well-extended (Figs. 6a–b). They had the same trophi as the type (Fig. 6c), but the peduncle was never drawn together and of a previously undescribed length (cf. Koste 1972, 1978). For development of the peduncle see Summerfield-Wright (1959). We regard this population as a new form.
Measurements: Total length 300–800 μm, corona width 100–150 μm, peduncle 300–426 μm (in lit. only to 200 μm).
Lit: Shiel & Koste 1979.

Collotheca edentata edentata (Collins), 1872
FIGS 7, 8

Syn: *Floscularia edentata* Collins, 1872.
Not previously recorded from Australia, this species was represented by a single female in sample 1485 (roadside pool, Queenstown road 1 km east of walking track to Frenchman's Cap, 8.xii.1985). Mastax and stomach (Fig. 8) were filled with four large *Euastrum*, many phyto- and zooflagellates and nearly 100 Bacillariophyceae. The species has been recorded from Europe, N. & S. America and E. Asia, and apparently is cosmopolitan (Kutikova 1970; Koste & Jose de Paggi 1982). For biology see Penard (1914) and Koste (1978).
Measurements: Total length 490 μm, corona width 100 μm, body width 173 μm, foot incl. peduncle 158 μm, peduncle 18 μm, peduncle plate 20 μm.
Ecology: 18°C, pH 4.6, 36.4 μS cm $^{-1}$.
Lit. Collins 1872, Koste 1986.

Lecane (s.str.) *pumila* (Rousselet), 1906
FIGS 9a–b

L. pumila also is new for the Australian region. This species belongs to the few taxa in the genus which do not have separate dorsal and ventral lorica plates, but a soft undivided integument. Hauer (1936), in a monograph on *L. pumila*, pointed out that rather than a notammatid, as intially described by Rousselet, this taxon is a *Lecane* which lives in algae and mosses of running waters. The localities in which this minute animal are found are widely separated: N. Germany, Scotland, Sweden, Java and Sumatra. Kutikova (1970) includes Czechoslovakia, Roumania and Canada, but locality details are not given.
A single animal was present in sample 1482 (Lake St Clair, 7.xii.1985, near kiosk). 17°C, pH 7.3, 20.1 μS cm $^{-1}$.
Measurements: Lorica length 72 μm, toes 12 μm incl. claw, claw 4 μm.
Lit: Rousselet 1906, Voigt 1957.

Lecane nana (Murray), 1913
FIG. 10

A population of *L. nana* occurred in a stock dam 5 km south of Tunbridge (1471, 5.xii.1985), and is a first record for Tasmania. The specimens did not correspond to the figure given by Harring & Myers (1926 Pl. 34:1–2). The lorica was not so subcircular, but more elongated and the toes not so attenuated. The Tasmanian forms showed more conformity with the taxon drawn by Hauer (1925:Fig. 8) (see also Koste 1978:205, Pl. 68:10). The toes are very straight and the terminal claws curve outwards.
Measurements: Dorsal plate 61 μm, ventral plate 68 μm, lorica width 58 μm, anterior margin 43 μm, toes incl. claws 28–29 μm.
Ecology: 18.5°C, pH 7.4, 565 μS cm $^{-1}$. *L. nana* is distributed in the Palae- and Neoarctic, Neotropics and Oriental region, and was recorded from Queensland by Russell (1961).

Lecane (s.str.) ohioensis appendiculata (Levander), 1894
FIG. 11

In sample 1381 (brackish stock dam, St Mary's road near St Helens, 29.xi 1985) were 34 specimens

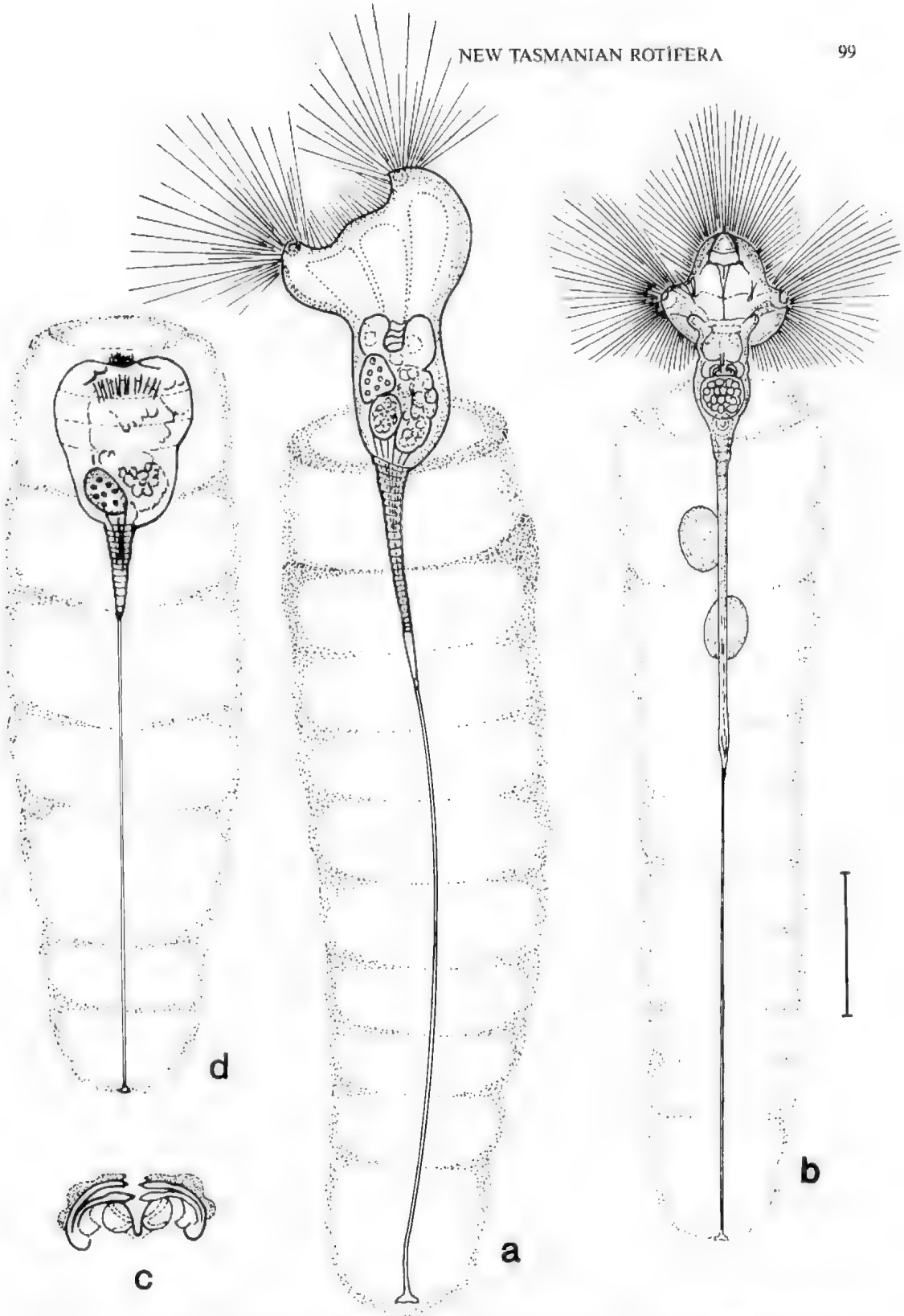


Fig. 6. *Collotheca campanulata longicaudata* (Hudson), 1883. Lake Pedder form. a. female, lateral, b. dorsal. c. trophi, ventral, d. contracted. Scale bar 100 μm.

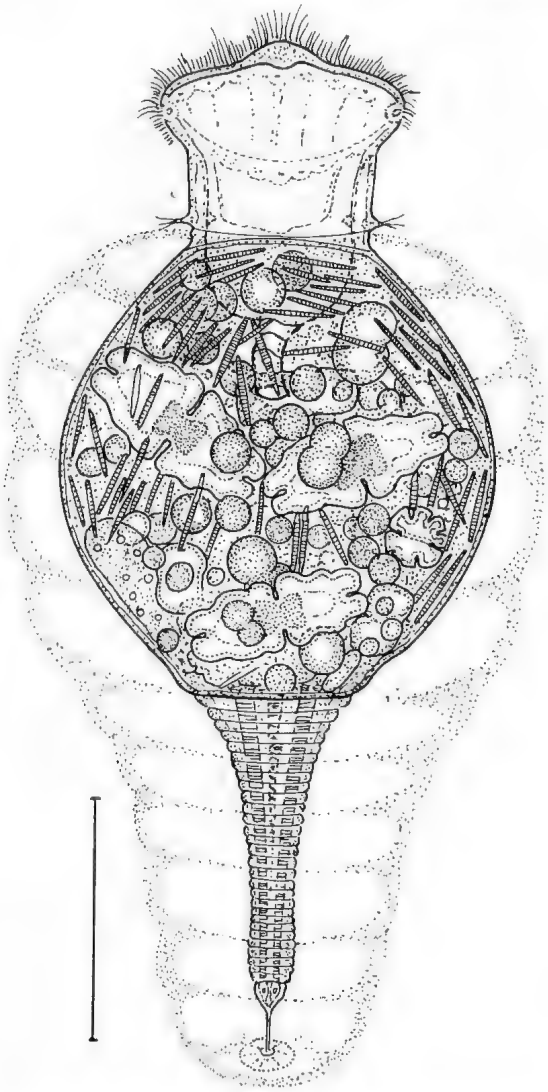


Fig. 7. *Collotheca edentata* (Collins, 1872. Female, dorsal. Scale bar 100 μm.

belonging to the taxonomically difficult *Lecane ludwigi-ohioensis* group. All taxa are distinguishable by the different appendices of the ventral lorica plate (see Koste 1978 Pl. 71:1–10). There are, however, intermediate forms to *L. ludwigi* and also to *L. ohioensis.* The present population is uniform (Fig. 11). The appendices are all short, slightly narrowed laterally before the end (marked by a convex line). Such a taxon was described as *Cathypna appendiculata* by Levander in 1894. Koste (1978) called the brackish water rotifer *Lecane ohioensis* f. *appendiculata* (Levander), 1894. In view of its specific ecological demands we probably are justified in changing its rank to that of ssp. (see also Koste 1978:213; De Ridder 1961).

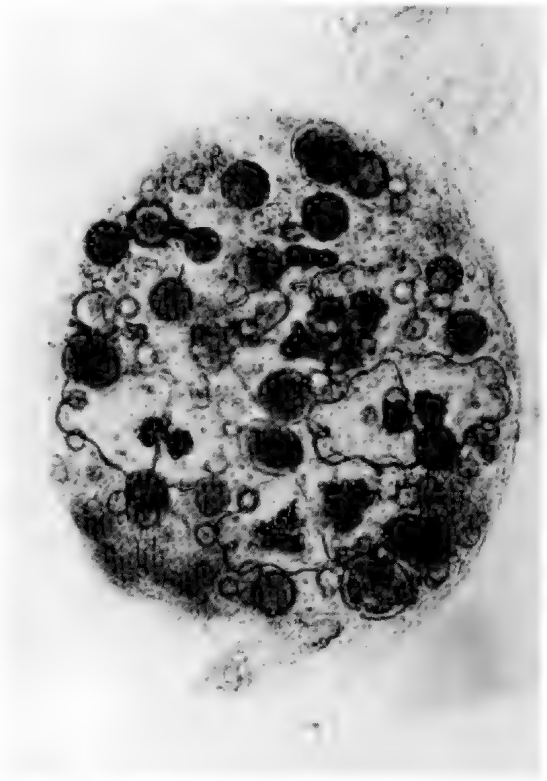
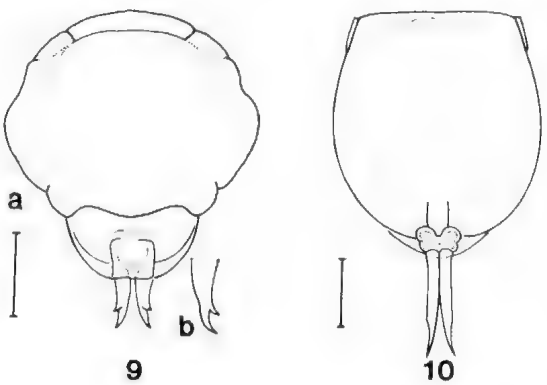


Fig. 8. *C. edentata,* micrograph of specimen with gut distended with algae.



Figs 9, 10. 9. *Lecane* (s. str.) *pumila* (Rousselet), 1906. a. dorsal, b. toe, lateral. 10. *Lecane* (s. str.) *nana* (Murray), 1913. Ventral. Scale bar 20 μm.

Measurements: Total lorica length 132 μm, dorsal plate length 87 μm, dorsal plate width 86 μm, ventral plate width 72 μm, anterior margin 52 μm, toes 39 μm.

Ecology: 19.0°C, pH 7.8, 6120 μS cm^{-1}. Cosmopolitan in oligo-mesohaline waters. Recorded

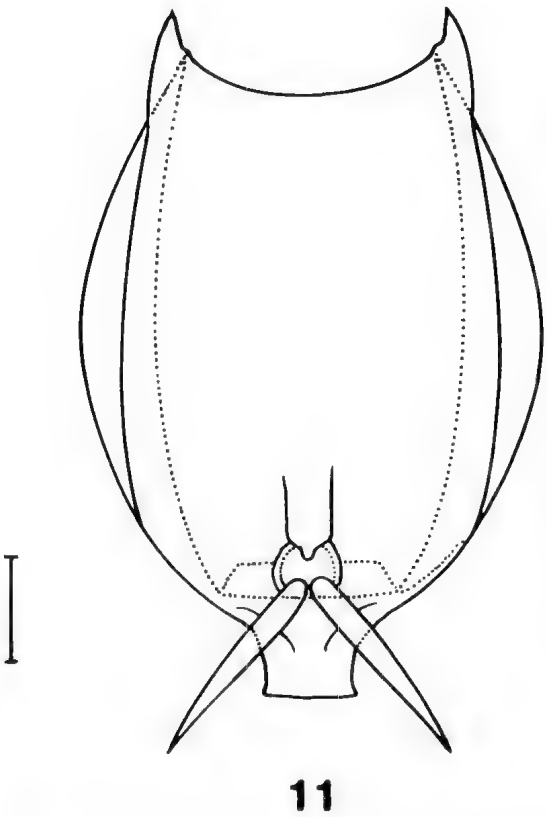


Fig. 11. *Lecane* (s. str.) *ohioensis appendiculata* (Levander), 1894. Ventral. Scale bar 20 μm.

from Queensland (Colledge 1914) and Tasmania (Koste & Shiel 1986a).

Lepadella acuminata (Ehrenberg), 1834
FIG. 12

First record for Tasmania, commonly in stock dams, acid waters. Probably pancontinental, recorded from Qld (Colledge 1911), Vic. (Green 1981), N.T. (Koste 1981) and W.A. (Koste *et al* 1983).
Measurements: Lorica length 90 μm, lorica width 60 μm, toes 22 μm.
Ecology: 16.0–23.5°C, pH 54.4–7.8, 42–1020 μS cm^{-1}.

Lepadella ovalis (Müller), 1786 (?f. nov.)
FIG. 13

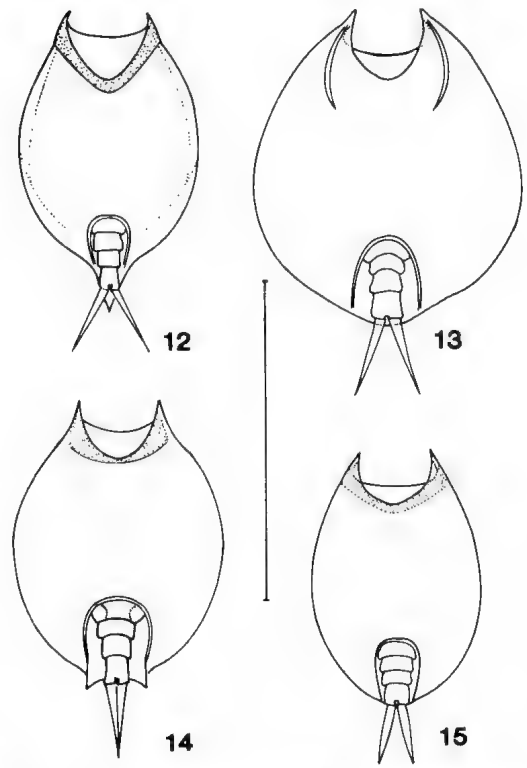
A minute form, possibly an ecotype, occurred in sample 1469 (Lake Dulverton near Oatlands, 5.xii.1985).
Measurements: Lorica length 87 μm, lorica width 83 μm, toes 25 μm (cf. Koste 1978 Pl. 60:1).
Ecology: 18.0°C, pH 7.7, 3330 μS cm^{-1}.

Lepadella patella (Müller), 1786
FIG. 15

Another extremely small form co-occurring with *L. ovalis* in sample 1469, and also found in two acid stock dams at Huonville (1435/37, 1.xii.85).
Measurements: Lorica length 79 μm, lorica width 54 μm, toes 18 μm (cf. Koste 1978 Pl. 59:2).
Ecology: 18.0–24.5°C, pH 3.4–7.7, 45.5–3330 μS cm^{-1}.

Lepadella patella biloba Hauer, 1958
FIG. 14

In sample 1502 (stock dam 36 km south of Burnie, 11.xii.1985) was a population resembling this subspecies, which was first described from Australia in Yarnup Swamp, W.A. (Koste *et al* 1983). There is considerable variation in the described lorica forms of *L. patella,* particularly the foot opening. In the absence of a detailed study of morphological variation, we retain the subspecific ranking for this



Figs 12–15. 12. *Lepadella acuminata* (Ehrenberg), 1834. Ventral. 13. *Lepadella ovalis* (Müller), 1786. L. Dulverton form, ventral. 14. *Lepadella patella biloba* (Haver), 1958, ventral. 15. *Lepadella patella* (Müller), 1986. L. Dulverton form, ventral. Scale bar 100 μm.

form given by previous revisers (e.g. Kutikova 1970; Koste 1978). It is likely that a species complex is involved.
Measurements: Lorica length 109 μm, lorica width 65 μm, toes 22 μm.
Ecology: 16.5°C, pH 4.7, 42 μS cm $^{-1}$.

Lepadella rhomboides haueri (Wulfert), 1956
FIG. 16

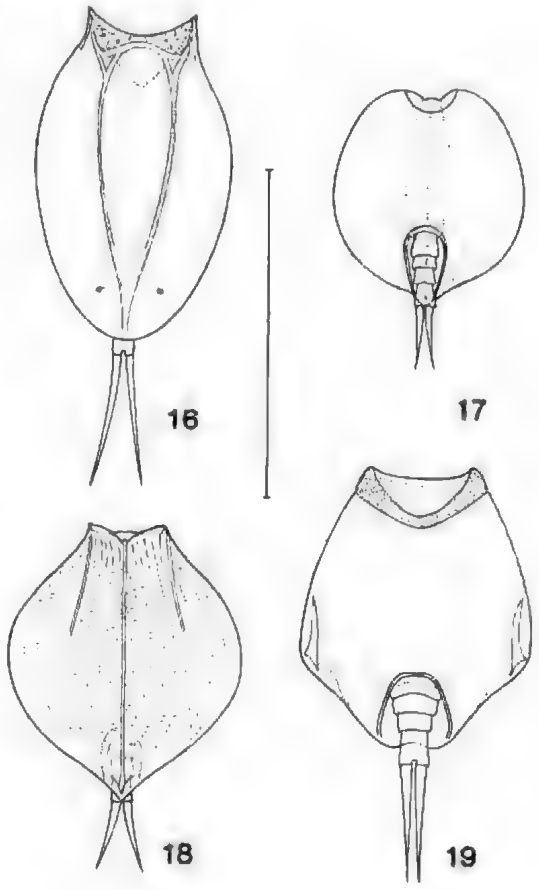
The type probably is pancontinental in Australia. Four individuals of this subspecies co-occurred with the above *Lepadella*.
Measurements: Lorica length 110 μm, lorica width 70 μm, toes 36 μm.

Lepadella triptera triptera Ehrenberg, 1830
FIGS 17, 18

An unusually small variant co-occurred with *L. ovalis* and *L. patella* in Lake Dulverton, Oatlands (sample 1469, Fig. 17), while the typical form occurred in Lake Augusta (1497, Fig. 18). This also may be an ecotype.
Measurements (Fig. 15): Lorica length 61 μm, lorica width 54 μm, toes 18 μm. (Fig. 16): length 76 μm, width 61 μm, toes 20 μm.

Lepadella tana sp. nov.
FIG 19

Materials: Four loricate females, samples 1457 (3), 1458 (1).
Holotype: Loricate female, sample 1457, collected 4.xii.85 by L. W. Tan. SAM V4020.
Paratype: Date and place of collection as for holotype, SAM V4026-7.
Type locality: Lake Pedder, deep bay south side of Strathgordon road 10 km east of Strathgordon (1 km east of boathouse). Dark, humic water, >2 m deep, no emergent vegetation. 16.5°C, pH 5.3, 46.2 μS cm $^{-1}$.
Description: Lorica broadly ovoid, ventral flat, dorsal medially convex in median cross section; anterior margin of head opening nearly straight, ventral margin with a weak v-shaped aperture. Behind the middle of the body a fold, on either side of which is a pointed, slightly curved spine, both directed apically. Foot-opening broad. Foot as usual with four segments; toes relatively long, straight and sharply pointed.
Measurements: Lorica length 79 μm; lorica width (medially) 61 μm; anterior width of lorica 29 μm; foot opening 18 × 18 μm; length of toes 29 μm; length of lateral spines 18 μm.
Discussion: This species is distinctive in the genus (see Koste 1978); the only other taxon resembling it is *Lepadella neboissi*, an apparently endemic Victorian species described by Berzins (1961). The latter has lateral folds, but no spines, and its toes are curved.
Etymology: Named after the collector, Ms Lor Wai Tan, Department of Agricultural Biochemistry, Waite Agricultural Research Institute, University of Adelaide.



Figs 16–19. 16. *Lepadella rhomboides haueri* (Wulfert), 1956. Dorsal. 17. *Lepadella triptera* Ehrenberg, 1830. Ventral. 18. *Lepadella triptera*. Dorsal. 19. *Lepadella tana* sp. nov. Ventral. Scale bar 100 μm.

Proales similis similis De Beauchamp, 1908
FIGS 20a–d

Sample 1380 (Diana's Basin, near St Helens, saline) contained sixteen females resembling *P. similis exoculis* Berzins, 1953, which was recorded from Western Australia. There is some doubt on the validity of this ssp. (Koste 1978) and we have referred the material to the typical form, although we could not detect a median red eye as described for *P. similis* type. In our experience the colour of rotifer eyes disappears in minute species if they are

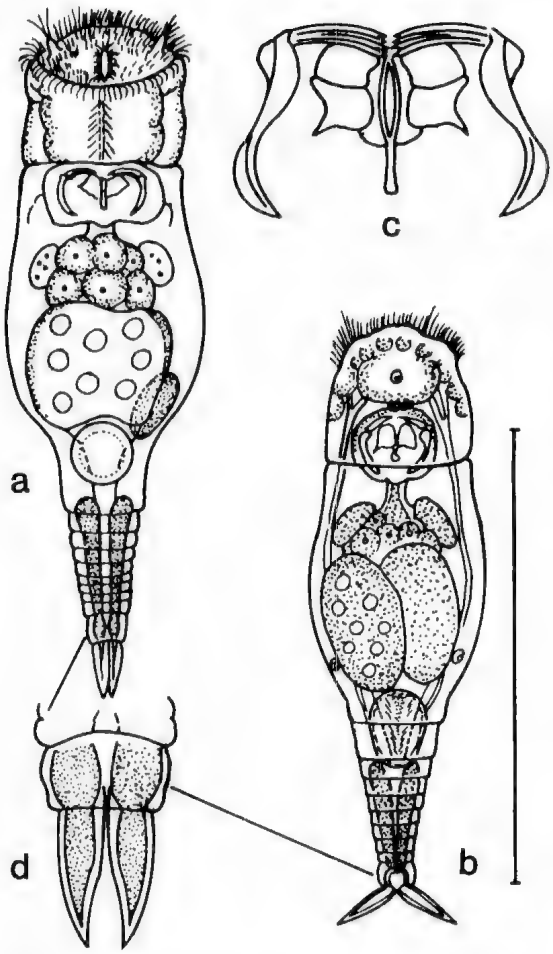


Fig. 20. *Proales similis* De Beauchamp, 1908. a. Female, ventral, slightly contracted, b. female, ventral (coll. Dr C. K. Brain, Transvaal Museum, S. Africa), c. trophi, d. toes with foot glands. Scale bar 100 μm.

retained in formalin-preserved collections. The type is known from saltwaters in Europe, Africa, N. America, S. America.
Measurements: Total length of stretched but preserved females 133–150 μm; toes 13 μm; trophi 15–20 μm.
Ecology: 19.0°C, pH 8.9, 34 800 μS cm^{-1}.

Ptygura barbata Edmondson, 1939
FIG. 21a

Sample 1421, a stock dam 9 km north of Triabunna, contained 4 ♀ ♀ of *P. barbata*, which resembles *P. longicornis* (Davis) (recorded from the mainland by Whitelegge 1889 and Anderson & Shephard 1892). The best morphological characteristic of *P. barbata* is the dorsal projection between the lateral antennae, which is formed as a bun-shaped process. A peduncle was not visible.
Measurements: Tube length — 400 μm, contracted animal — 200 μm.
Ecology: 16.5°C, pH 5.2, 216 μS cm^{-1}.
Lit: Edmondson 1939:463, Figs 21–24; Koste 1974;36, Figs. 23a–c.

Ptygura cf. *brachiata* (Hudson), 1886 (?f. nov.)
FIGS 21b–c

Sample 1447, a roadside pool, Hartz Mountains National Park, containded 30 ♀ ♀ in brownish tubes with a more yellow transparent top. Contracted animals with long lateral antennae and a double pointed blunt hook above the head closure. A very long peduncle unknown in this species resembles *P. linguata* Edmondson, 1939, but other

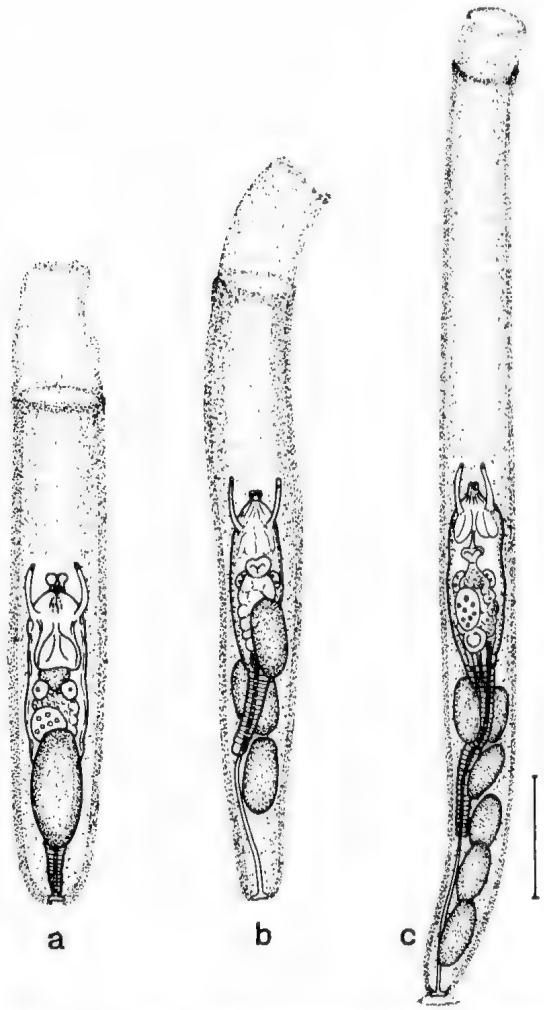


Fig. 21. a. *Ptygura barbata* Edmondson, 1939. Female contracted in tube. b–c. *Ptygura* c.f. *brachiata* ?n.f. Females contracted in tubes. Scale bar 100 μm.

morphological characteristics are like those of *P. brachiata* (Hudson), 1886 (see Koste 1970, Pl. 4a–e). Determination of the status of this taxon awaits further (uncontracted) material.
Measurements: Tubes 792–798 μm; contracted animals 340–420 μm; lateral antennae 35–40 μm; peduncle 170–216 μm; subitaneous egg 36 × 78 μm.
Ecology: 16.6°C, pH 3.8, 63.6 μS cm^{-1}.
Lit. Edmondson (1939, 1940), Koste (1978).

Ptygura tacita Edmondson, 1940
FIG. 22

Sample 1435 (stock dam, Huonville road south of Hobart) and 1446 (roadside pool 12 km from Hartz Mt National Park, west of Geeveston) contained 6 and 12 females respectively in broad hyaline tubes, the inner lumen with a characteristic narrowing at the bottom.
Measurements: Tubes 450–800 μm; peduncle 200–270 μm; subitaneous egg 25 × 82 μm. For other measurements see Koste 1978:546.
Ecology: 16.5–24.5°C, pH 3.9–5.7, 45.5–65.0 μS cm^{-1}.
Lit: Edmondson 1939, 1940.

Ptygura melicerta socialis (Weber), 1888
FIG 23

In sample 1490 (Botanical Gardens Pond, Hobart) some contracted and also extended *Ptygura* were found in cyanophyte colonies. Fig. 23 shows a free-living female. A circular corona and very long foot were present. A tube was not visible; nor were two minute hooks in the neck under the dorsal corona, an important characteristic of *P. melicerta melicerta* (Ehrenberg, 1832). Whitelegge (1889) recorded a *P. melicerta* from N.S.W., however the description is incomplete; the morphologically distinctive presence or absence of hooks in the neck is not mentioned. The animal resembles *P. melicerta socialis* (cf. Weber 1888 p. 647 Fig. 28:1–4). The N.S.W. record also may be this taxon. See Koste (1978:550–551, Pl. 205:2a, b).

Testudinella mucronata tasmaniensis ssp. nov.
FIGS 24a, b, 25

Material: Ten loricate females were present in samples 1421 (stock dam, Triabunna) and 1457 (Lake Pedder).
Holotype: Loricate female, sample 1421, on preserved slide. Coll. R. J. Shiel 29.xi.1985. SAM V4021.
Paratypes: Date and place of collection as for holotype, two slides, SAM V4029.
Type locality: Stock dam 9 km north of Triabunna (1 km north of Ashgrove Creek) (42°26'S, 147°55'E), 16.5°C, pH 5.2, 216 μS cm^{-1}.

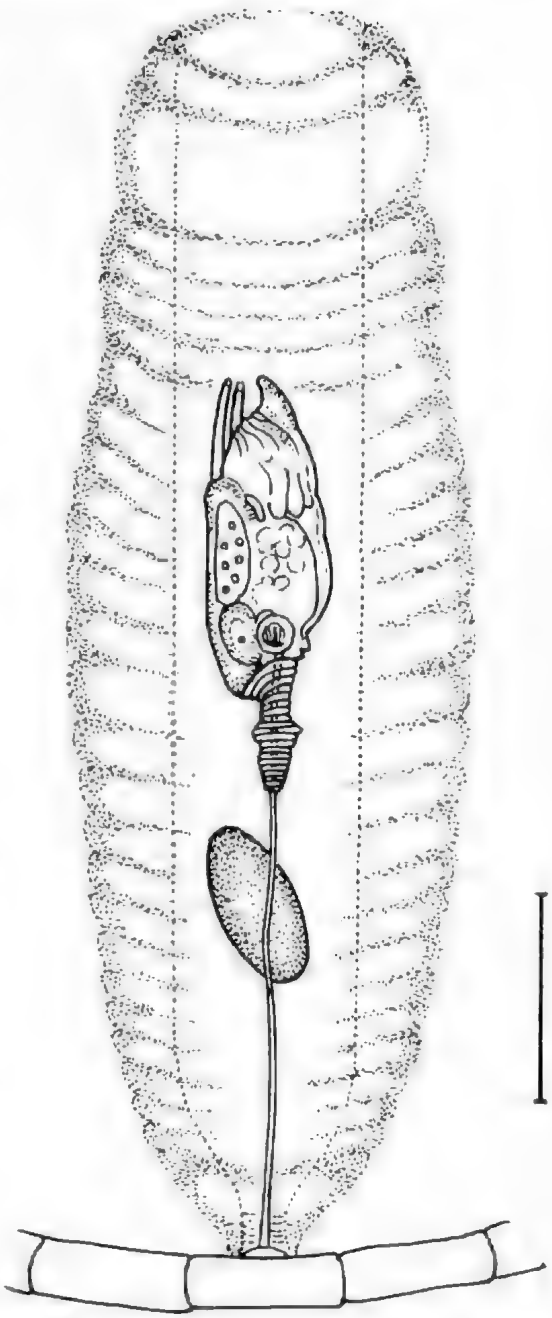


Fig. 22. *Ptygura tacita* Edmondson, 1940. Female contracted in tube. Scale bar 100 μm.

Description: Shape resembles *Testudinella mucronata* (Gosse), 1886 (cf. Koste 1978 Pl. 195:5a–c). Head-aperture normal but directed ventrally, with a collar. Dorsal posterior lorica with symmetrical folds, the median with a short rounded top. The type has a soft lorica surface and no folds.

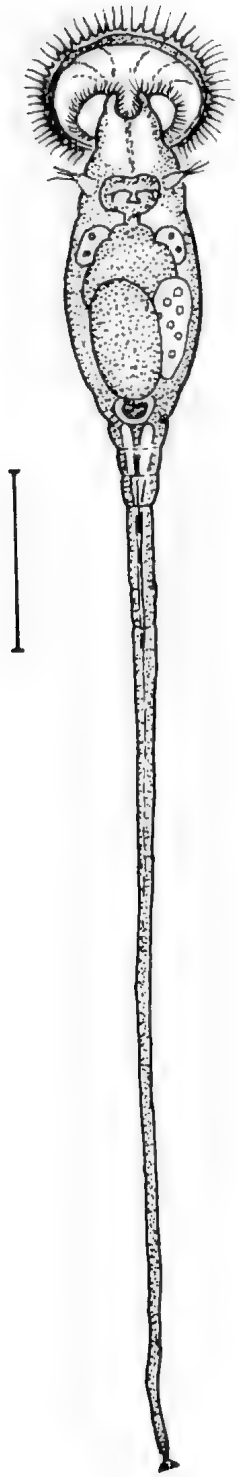


Fig. 23. *Ptygura melicerta socialis* (Weber), 1888. Freeliving female, ventral. Scalar 100 μm.

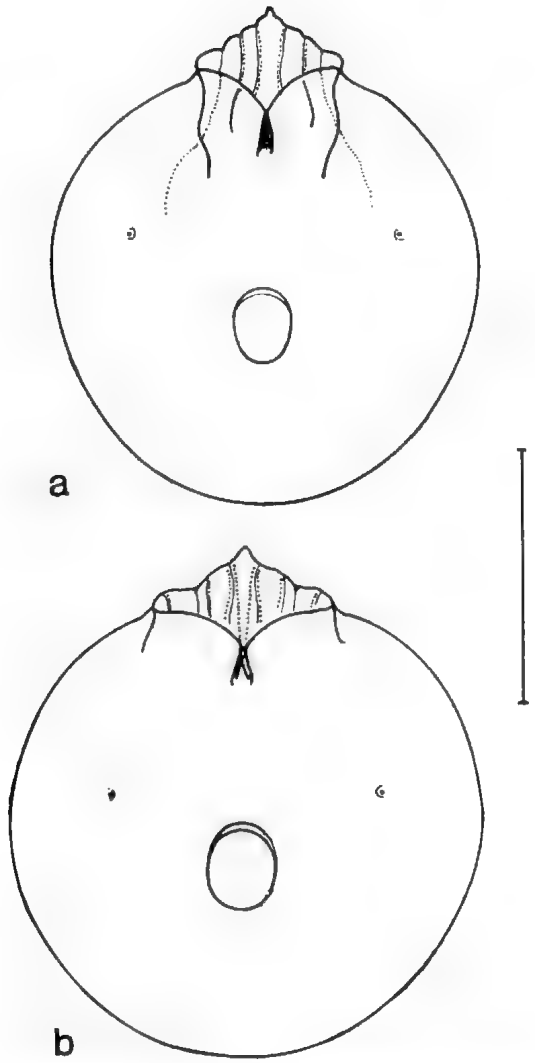


Fig. 24. *Testudinella mucronata tasmaniensis* ssp. nov. a, b. loricas of different females. Scalar 100 μm.

Foot-opening median at beginning of second third of ventral plate.

Measurements: Lorica length 200–210 μm; lorica width 176–198 μm; foot-opening 28 × 29 μm; head aperture 70–75 μm wide, 35–39 μm deep.

Discussion: T. mucronata (Gosse), 1886 has not been recorded from Australia. It is smaller than the Tasmanian material (lorica length to 170 μm, width to 140 μm). Larger size, head-opening projection and presence of a collar distinguished the Tasmanian specimens from the type, however the morphological variation in the *T. patina-ohlei-mucronata* group suggests that specific ranking for the new taxon is not, on present evidence, warranted.

Fig. 25. *T. mucronata tasmaniensis*, micrograph of loricate female.

In a collection from the south-east of S. Australia (W. D. Williams, 10.ix.1982) we found ten specimens with all characteristics of *T. mucronata tasmaniensis;* the rotifer may be more widely distributed across southern Australia.

Discussion

Community composition

There were marked differences in rotifer communities between habitat types. Using the Shannon-Weaver index (H') as a convenient measure of species richness, the habitats sampled can be ranked in order of decreasing rotifer community diversity: natural lakes (x H' =2.44) > rivers flowing from them (H' = 2.40) > marshes (H' = 1.80) > streams (H' = 1.77) > impoundments (H' = 1.66) > roadside ditches (H' = 1.44). This apparent reduction in community complexity in part reflects increasing habitat ephemerality, although there were extremes within each category resulting from site-specific factors. Stock dams, for example, ranged from saline to fresh, and from turbid with no emergent vegetation to clear waters with marginal emergent reeds. Rotifer diversity correspondingly showed a wide range, from a H' of 0.31 (#76 Fig. 1; 3 spp.., 99% *Keratella australis*) to 3.31 (#86 Fig. 1, 11 taxa relatively evenly distributed). In some habitats the presence of predatory cyclopoids and small corixids may have depressed rotifer community diversity.

Because the H' index takes into account apportionment of the taxa, sites with the greatest number of species did not have the highest community diversity. For example, Lake Dulverton (#42 Fig. 1, H' = 3.21) and Lake Pedder (#88, H' = 1.74) each had 17 rotifer species on the sampling date, but whereas the Lake Pedder community was dominated by *Keratella cochlearis* (70%), at least six taxa made up of 70% of the Lake Dulverton community. The greatest number of species in the 1984 sample series was 25 rotifer taxa from a dam (site #22, Fig. 1) near Ulverstone in the northwest. The highest in 1985 was 18 from a stock dam (#85) at Huonville.

In comparison, rotifer communities on the mainland appear to be more diverse. Collections from Goulburn R. billabongs in Victoria two days after the last of the Tasmanian series in Dec. 1985 produced up to 32 rotifer taxa (H' = 4.24) in a single habitat. H' >5 has been recorded for rotifer communities on the floodplain of the Magela CK, N.T. (>80 species present) (Shiel & Koste 1983). Few Tasmanian localities sampled had comparable emergent vegetation to effectively partition the habitat and provide microniches as is seen in mainland billabongs. Acid waters are not seen as an inhibitor of community diversity in this study; the most common Tasmanian species are acidophiles or eurytopic (Koste 1978), and the highest community diversities in the Magela Ck study were from waters more acid than those sampled in Tasmania.

The noted disparity in species diversity between habitats included marked differences in species composition within each category of habitat; even adjacent stock dams usually had different species dominants, and the number of shared taxa decreased with increasing geographical distance. Stock dams (#80–84) near Southport, for example, within 200 m of each other, contained 21 rotifer taxa. Only two occurred in all four dams, and another two occurred in three of the four. This restricted distribution of most rotifers is reflected in Table 1, where 81% of the new records for Tasmania were found in only one or two habitats, and is in accord with observations from the mainland, where >50% of taxa are known from only single localities.

Seasonality

Seasonal changes in community structure were reflected in the disparity of species recorded in

TABLE 1. *Systematic list of Rotifera recorded from Tasmania for the first time.* An asterisk (*) indicates a new record for Australia. Occurrence is shown by + = rare (one or two localities), ++ = limited distribution (<20% of localities, +++ = more widespread (>20% localities). Habitat type is given by S = stock dam, P = pond or small roadside pool, L = lake or large impoundment, R = river or stream (flowing).

	Abundance	Habitat
Bdelloidea		
1. *Dissotrocha macrostyla tuberculata* (Gosse)*	+	P
2. *Habrotrocha* Bryce sp.	+	P
3. *Rotaria macrura* (Ehrbg)	+	L
4. *R. rotatoria* (Pallas)	++	S/P
5. *R. tardigrada* (Ehrbg)	+	P
Ploimida		
6. *Epiphanes macrourus* (Barrois & Daday)	+	L
7. *Brachionus urceolaris* Müller)	+	S
8. *B. lyratus tasmaniensis* ssp. nov.*	+	S
9. *Euchlanis incisa* Carlin	+	L
10. *E.* cf. *oropha* Gosse	+	S
11. *Colurella obtusa* (Gosse)	++	S/P
12. *Squatinella mutica* (Ehrbg)	+	S
13. *Lepadella acuminata* (Ehrbg)	++	S/P
14. *L. ovalis* Müller)	+	L
15. *L. patella* (Müller)	+++	S/L/R
16. *L. patella biloba* (Hauer)	+	S
17. *L. rhomboides haueri* Bartos	++	S
18. *L. triptera* (Ehrbg)	++	S/L
19. *L. tana* sp. nov.*	+	P/L
20. *Lecane (M.) acus* Harring*	+	P
21. *L. (M.) hornemanni* (Ehrbg)	++	S/L
22 *L. (M.) nana* (Murray)	+	S/L
23. *L. (M.)* cf. *sinuata* Hauer*	+	S/L
24. *L.* (s. str.) *pumila* Rousselet*	+	L
25. *L.* (s. str.) *signifera* (Jennings)	+	P
26. *Proales fallaciosa* Wulfert	+	L
27. *Proales* cf. *similis* De Beauchamp*	+	L
28. *Lindia truncata* (Jenning)	+	R
29. *Itura aurita* (Ehrbg)	+	S/L
30. *Resticula melandocus* (Gosse)	+	P
31. *Notommata pachyura* (Gosse)	+	L
32. *N. tripus* Ehrbg	+	S
33. *Pleurotrocha petromyzon* Ehrbg	+	L
34. *Cephalodella gibba microdactyla* Koch-Althaus*	+	P
35. *C. intuta* Myers	+	S
36. *C. mucronata* Myers	++	P/L
37. *C. lindamaya* sp. nov.*	+	S
38. *Trichocerca rattus carinata* (Ehrbg)	+	L
39. *T. insignis* (Herrick)	++	S/L
40. *T.* cf. *insulana* Hauer	+	L
41. *Gastropus hyptopus* (Ehrbg)	+	S
42. *G. stylifer* Imhof	+	L
43. *Ascomorpha ovalis* (Bergendahl)	++	S/L
44. *Polyarthra* cf. *longiremis* Carlin	+	L
45. *Dicranophorus forcipatus* (Müller)	+	P
46. *Aspelta aper* Harring	+	L
47. *Encentrum* cf. *diglandula* (Zawandowski)*	+	P
48. *Testudinella patina* (Hetmann)	+	R
49. *T. mucronata tasmaniensis* ssp. nov.*	+	S/L
50. *Beauchampia crucigera* (Dutrochet)	+	S
51. *Floscularia janus* (Hudson)	+	S
52. *Ptygura barbata* Edmondson*	+	S
53. *P. brachiata* (Hudson)	+	P
54. *P. crystallina* (Ehrbg)	+	P
55. *P. melicerta socialis* (Weber)*	+	P
56. *P. tacita* Edmondson	++	S
57. *Sinantherina* cf. *socialis* (Linnaeus)	+	S
58. *Hexarthra fennica* (Levander)	+	S/L
59. *Collotheca* cf. *ambigua* (Hudson)	-	P
60. *C. campanulata longicaudata* (Hudson)*	++	S/L
61. *C. edentata* Collins)*	+	P
62. *C. libera* (Zacharias)*	+	L
63. *C. ornata natans* Tschugunoff*	+	L

successive sample series. The autumn series in 1984 produced 118 taxa, 75% of which were first records. The spring 1985 series from the same localities produced 133 taxa, 47% of which were first records. Further collecting from these localities probably will add a decreasing proportion of new records, however only about 100 localities have been sampled. The profusion of standing waters in Tasmania would suggest that the total rotifer fauna is considerably greater, possibly exceeding that of the mainland (at present 600+ taxa).

Most abundant species in the 1984 series, occurring in >20% of localities, were *Keratella slacki* > *K. cochlearis* > *Trichocerca similis* > *K. australis* > *Polyarthra dolichoptera* > *Filinia longiseta* > *P. vulgaris* > *K. procurva/F. pejleri* > *Lecane lunaris*. Fewer taxa occurred in > 20% of the 1985 samples: *(K. slacki)* (35%), *T. similis* (32%), *L. lunaris* (29%), *K. cochlearis* (26%), *P. vulgaris* (25%) *L. hamata* (24%) and *K. australis* (22%). Only *K. australis* and *K. slacki* are endemics (pancontinental on the mainland). The remainder are widely tolerant cosmopolitan taxa.

Zoogeography

To date, the following rotifers are known only from Tasmania: *Brachionus lyratus tasmaniensis, Lepadella tana, L. tyleri, Lecane tasmaniensis, Cephalodella lindamaya, Aspelta tilba, Testu-*

dinella hasseyi, T. mucronata tasmaniensis and *T. unicornuta*. This represents about 4% endemicity, cf. approximately 12% on the mainland (Dumont 1983). Undoubtedly the degree of endemicity will prove higher with more intensive collecting.

The anomalous distributions of warm-stenothermal "cosmotropical" rotifers at 42-43°S was noted in our first Tasmanian survey report (Koste & Shiel 1986a). The spring 1985 collections provided further evidence: 14 of the taxa listed in Table 1 are known only from Qld or the N.T. Several others are known from single localities in northern N.S.W. or the southwest of W.A. These distributions probably reflect real spatial patterns rather than patchy collecting; more than 1000 collections from southern Victoria to southern Qld 1976-81 over all seasons and all habitat types did not contain them.

The nature of the habitats provides part explanation: acid waters are abundant in Tasmanian and tropical nothern Australia. The waters of our other major collecting areas to date (the Murray-Darling basin and south-west W.A.) are predominantly alkaline. The rotifers preferring alkaline waters, particularly species of *Brachionus*, have diversified in these habitats (Shiel 1983), but notably are absent from tropical Australia and Tasmania. The few *Brachionus* recorded from these areas are tolerant of extreme biotopes (Koste 1981) or are new, and presumably acidophiles.

It is interesting to speculate that these disjunct distributions may represent a relict rotifer fauna in Tasmania waters persisting from a period when the climate was tropical. Fossil studies (e.g. Hill & MacPhail 1983) have demonstrated that parts of Tasmania (and south-eastern Australia) had temperate rainforest in the Oligocene. Environmental stresses (principally Miocene cooling) led to reduction in floristic diversity and ultimately the modern Tasmanian vegetation. An aquatic group such as the rotifers would be buffered against environmental stresses, particularly when these events were less severe than the glaciation in the northern hemisphere. The persistance of a faunule in the more stable conditions of lakes is perhaps more plausible than invoking large-scale dispersal from northern Australia by wind or on the feet of birds. Fossil evidence would answer the question, but small size and poor preservation provide few rotifers in the fossil record. They were present during the tropical period in southern Australia; Southcott & Lange (1971) identified a *?Keratella* from the Miocene of South Australia, but there are no Tasmanian records.

Acknowledgments

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FROGS OF THE GENUS UPEROLEIA GRAY (ANURA: LEPTODACTYLIDAE) IN SOUTH-EASTERN AUSTRALIA

BY MARGARET DAVIES & M. J. LITTLEJOHN

Summary

A review of the species Uperoleia of south-eastern Australia has resulted in the clarification of the status of several taxa and the description of two new species. Recent redescriptions of Uperoleia laevigata and U. rugosa are expanded to incorporate data on morphology, osteology and structure of advertisement call from across their extensive geographic ranges. Variation in these features is examined and, in many cases, the limits of variability for certain characters are established. U. fimbrianus (Parker) is placed in the synonymy of U. rugosa (Andersson). Two new species, U. tyleri sp. nov. and U. martini sp. nov. are described from south-eastern coastal N.S.W. and eastern Victoria.